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SUPERSEDING
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DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION SPECIFICATION

ANTENNA, VERTICALLY POLARIZED, COMMUNICATION, 225-400 MHz

1. SCOPE

1.1 Scope.- The equipment described herein is a high-gain, vertical pattern tilt, vertically polarized, UHF communications antenna for use at unattended air/ground communication facilities.

2. APPLICABLE DOCUMENTS

2.1 FAA documents.- The following FAA documents, of the issues specified in the invitation for bid or request for proposals, form a part of this specification:

FAA-D-1272	Instruction Booklets, Electronic Equipment
FAA-G-2100/1	Electronic Equipment, General Requirements; Part 1 General Requirements for all Equipments
FAA-STD-013	Quality Control Program Requirements

(Copies of this specification and other applicable FAA documents may be obtained from the Federal Aviation Administration, Washington, D. C. 20590, Attention: Contracting Officer. Requests should fully identify material desired, i.e., specification numbers, dates, amendment numbers, complete drawings numbers; also request should state the contract involved or other use to be made of the requested material.)

2.2 Military specification.- The following Military specification, of the issue in effect on date of the invitation for bids or request for proposals, forms a part of this specification:

MIL-E-17555 Electronic and Electrical Equipment and Associated
Repair Parts, Preparation for Delivery of

(Single copies of the applicable Military specification may be obtained from the Federal Aviation Administration, Washington, D. C. 20590, Attention: Contracting Officer. Requests should fully identify material desired, i.e., specification numbers, dates, amendment numbers; also requests should state the contract involved or other use to be made of the requested material. Note that requests for MIL specifications will be forwarded to Military supply depot for filling, hence ample time should be allowed.)

3. REQUIREMENTS

3.1 Equipment to be furnished by the contractor.- Each antenna furnished by the contractor shall be complete and ready for operation, including mating plugs for the antenna transmission line receptacle and power cable receptacle. Instruction booklets shall be in accordance with FAA-D-1272, and quantities shall be furnished as specified in the contract schedule.

3.2 Test conditions and power source

3.2.1 Service conditions.- The ambient conditions shall be those of Environment III (1-3.2.23, FAA-G-2100/1).

3.2.2 Power source.- The equipment shall operate from a single-phase, two wire AC line power source. The design-center voltage (1-3.2.21, FAA-G-2100/1) shall be 120 V.

3.3 Mechanical requirements

3.3.1 Mechanical configuration, general.- The antenna assembly shall be a free standing vertically mounted unit. The unit will be installed on various type mounting platforms, including steel towers, wood poles and platforms, building parapets, etc., at locations subjected to severe wind and icing conditions.

3.3.2 Antenna enclosure.- All elements (i.e., dipoles, phasing harness network, etc.) shall be completely enclosed in a homogeneous fiberglass weather-proof cylindrical housing with a permanently affixed metal base mounting bracket and removable top cap. The cylindrical housing shall have an outside diameter of $4 + 1/8$ inches with a minimum wall thickness of $1/8$ inch. The fiberglass shall have a minimum tensile and compression strength of 20,000 P.S.I. The contractor shall furnish the fiberglass manufacturer's strength-of-material data to prove full compliance. The enclosure shall be water-proof and insect-proof, and shall include $1/16$ inch weepholes at the base within the mounting bracket for the drainage of moisture which may result from condensation.

3.3.3 Radiating elements.- The antenna shall consist of a minimum of five dipoles.

3.3.4 De-icing.- Heater wires shall be embedded in the fiberglass antenna enclosure in such a manner that the wires will not be damaged by exposure to Environment III service conditions. The spacing of the heater wires throughout the fiberglass enclosure shall not exceed 5/8 inch. The wire shall be embedded in such a manner as to be encapsulated by the antenna enclosure. The antenna enclosure surface shall be smooth with the wire installed. The power consumption shall be within the range of 1000 to 1200 watts when connected to a 60 Hz, 120 V power source. The heater wires shall terminate in a MIL-C-5015, Type MS-3102A-20-24 receptacle located on the recessed plate 3.3.6 and be accessible for attaching external Government-furnished power wiring.

3.3.5 Enclosure top cap.- The enclosure shall be equipped with a removable anodized aluminum top cap to provide access to and removal of the antenna elements with the associated mounting hardware and phasing harness. The top cap shall be equipped with an external eye and be of sufficient strength to support the antenna assembly weight while being raised to antenna support tower mounting platforms. The inner diameter of the eye shall be a minimum dimension of 7/8 inch.

3.3.6 Antenna mounting bracket 3.3.2.- The antenna fiberglass housing shall be securely and permanently attached to a tubular anodized aluminum mounting bracket which can be attached to various vertical mounting surfaces by the use of 1/2 inch through bolts or lag screws. Mounting holes shall be positioned horizontally through the center of the mounting bracket. The vertical distance between the mounting holes shall be 20 inches center to center. There shall be a flat surface on one side of the mounting bracket which shall extend a minimum of one inch in all directions from the center of the mounting holes. The design of the flat surface shall be such as to allow for the flush mounting of the mounting bracket. Sleeves shall be positioned between the mounting holes to prevent compression of the mounting bracket during installation. The mounting bracket shall be sufficiently strong to withstand the stresses encountered through the service conditions 3.2.1. A removable recessed plate shall be provided in the lower end of mounting bracket to which the RF and power cable connectors shall attach. The plate shall be recessed to a depth sufficient to protect the external connectors from the weather.

3.3.7 Overall dimensions and weight.- The weight shall not exceed 35 pounds. The overall height shall not exceed 13 feet. All outside diameters shall not exceed 4-1/2 inches.

3.3.8 Maintenance.- The antenna unit shall be so constructed as to readily allow the removal of all internal RF antenna components for repair or replacement. All connections within the RF cable harness shall be soldered. Shrinkable sleeves shall be utilized at each connection point. The only RF connectors utilized shall be the input connector (3.3.9) and connectors to fasten the braided sleeve of the coaxial cable to each dipole. The center conductor of the coaxial cable shall be soldered to the dipoles.

3.3.9 Transmission line connections.- The antenna RF receptacle shall be type N "Female" captive pin type.

3.4 Electrical characteristics

3.4.1 Frequency range.- The frequency range of the antenna shall be 225 through 400 megahertz (MHz), and it shall meet all the requirements of this specification without having to be adjusted or tuned.

3.4.2 RF power rating.- The antenna shall be capable of continuous operation with an 800 watt PEP signal input (200 watt carrier modulated 100% with a 1000 Hz signal).

3.4.3 RF impedance.- The antenna shall be designed for direct operation with a 50 ohm coaxial transmission line.

3.4.4 Standing wave ratio.- The standing wave ratio shall be not more than 2.0 through the frequency band.

3.4.5 Radiation characteristics.- When the antenna is oriented in its normal operating position and operating at all frequencies within the frequency band specified in 3.4.1, the radiated signal shall be vertically polarized and the radiation pattern shall also conform to the subparagraphs below.

3.4.5.1 Horizontal radiation pattern.- The horizontal radiation pattern shall be omnidirectional. The pattern strength shall not vary more than ± 1 dB measured at the main vertical lobe peak (3.4.5.2).

3.4.5.2 Vertical radiation pattern.- The main vertical radiation pattern lobe peak shall be tilted an average of $11^\circ \pm 2^\circ$ above the horizon. The limits of the main vertical lobe peak shall be a minimum of 5° and a maximum of 16° above the horizon. The main vertical lobe total width (angular displacement between -3 dB from peak points) shall be no less than 12° and no more than 32° . The vertical polarization gain at the peak of the main vertical lobe shall be a minimum of 4 dB over an isotropic antenna. The average gain at the vertical lobe peak shall be a minimum of 6 dB over an isotropic antenna. The minimum vertical polarization gain from the peak of the vertical lobe to the horizon shall be equal to or better than an isotropic antenna. Average angular tilt values of the main vertical radiation pattern lobe peak and average gain shall be determined by an average of measurements taken every five MHz from 225 to 400 MHz.

3.4.5.3 Vertical radiated pattern secondary lobe.- Peaks of all lobes below the horizon shall not exceed a level which is 5 dB below the peak of the main vertical lobe as defined in paragraph 3.4.5.2.

3.5 Nameplate.- A nameplate, furnished in accordance with paragraph 1-3.13 of FAA-G-2100/1, shall be mounted on the front surface of the antenna mounting bracket (3.3.6). The nameplate title shall be: COMMUNICATION ANTENNA, 225-400 MHz.

4. QUALITY ASSURANCE PROVISIONS

4.1 Design qualification test.- The following design qualification test shall be made at any condition within the range of Environment III service conditions and at any altitude as selected by the contractor:

(3.4.2) RF Power Rating.- This test shall be conducted at one frequency between 380 to 400 MHz under the conditions as stipulated in paragraph 3.4.2 for a minimum period of four hours. Upon completion of the test, the antenna shall be dismantled and thoroughly inspected for evidence of arcing, overheating, etc. In addition to the performance of the test, the contractor shall demonstrate by means of design calculations and part specifications, the ability of the equipment to meet the RF power rating at all combinations of temperature, humidity, and altitudes as defined under service conditions (3.2.1).

(3.2.1) Wind and Ice Loading.- Determination of compliance shall be accomplished in accordance with paragraph 1-4.10 of Specification FAA-G-2100/1.

4.1.2 Type tests.- The following type tests shall be made at any condition within the range of Environment III service conditions and at any altitude as selected by the contractor.

(3.3.4) Heater power consumption.

(3.3.2) Water-proofing.- The unit shall be subjected to water spray in all azimuths from a 45° angle above the unit for a minimum period of 30 minutes. The spray shall be adjusted to strike the antenna surface simultaneously and in a uniform manner. The density of the spray shall be such that a minimum of 10 gallons of water strike the antenna surface during this time period. The antenna shall be disassembled immediately upon termination of the water spray. There shall be no evidence of water within the antenna.

(3.4.5.1) Horizontal radiation pattern.- Gain measurements shall be made every 5 MHz from 225 to 400 MHz at the horizon and variations in pattern strength at main vertical lobe peak.

(3.4.5.2) Vertical radiation pattern.- Measurements shall be made every 5 MHz from 225 to 400 MHz to determine compliance on limit of angular displacement of vertical lobe peaks, vertical lobe width and minimum gain and average gain at the lobe peak and area between the lobe peak and the horizon.

(3.4.5.3) Vertical pattern secondary lobes.- Measurements shall be made at every 5 MHz from 225 to 400 MHz.

4.1.3 Production tests.- The following production tests shall be made at any condition within the range of Environment III service conditions and at any altitude as selected by the contractor.

- (3.3.4) Heater power continuity.
- (3.4.4) Standing wave ratio.- Measurements shall be made a minimum of every 5 MHz from 225 to 400 MHz.
- (3.4.5.1) Horizontal radiation pattern.- Measurements shall be made every 35 MHz from 225 to 400 MHz of gain at the horizon, and variations in pattern strength at the main vertical lobe peak.
- (3.4.5.2) Vertical radiation pattern.- Measurements shall be made every 35 MHz from 225 to 400 MHz to determine compliance on limits on angular displacement of vertical lobe peaks, vertical lobe width and minimum gain and average gain at the lobe peak and area between the lobe peak and the horizon.
- (3.4.5.3) Vertical pattern secondary lobes.- Measurements shall be made at every 35 MHz from 225 to 400 MHz.

4.1.4 Quality program requirements.- The contractor shall provide and maintain a quality control program which fulfills the requirements of FAA-STD-013. Accordingly, the following requirements of FAA-G-2100/1 are deleted: 1-4.1, 1-4.2.2 through 1-4.2.5, and last sentence of 1-4.3.1.1.

5. PREPARATION FOR DELIVERY

5.1 See MIL-E-17555.

6. NOTES

6.1 None.

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